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### Return to work after hand injury

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# Symptoms of Acute PostTraumatic Stress Disorder in Patients with Acute Hand Injuries

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*Purpose* Symptoms of posttraumatic stress disorder (PTSD) in patients with hand injuries may delay return to work, even when criteria of the Diagnostic and Statistical Manual of Mental Disorders–IV are not met. This study investigated which biomedical and psychosocial factors relate to symptoms of acute PTSD in hand-injured patients.

*Methods* Sixty-seven employed patients with hand injuries completed a number of questionnaires. The following factors were investigated: sociodemographic characteristics, injury severity, accident location, pain, satisfaction with hand functioning, aesthetics of the hand, social support, and coping styles. The primary outcome measure was the number of symptoms of PTSD. We analyzed factors that were univariately significantly associated with symptoms of PTSD using linear regression analysis, and explored interaction effects.

*Results* One patient met the criteria for PTSD; 44 patients experienced symptoms but did not meet the criteria (median, 1; interquartile range (IQR), 0–2); 22 patients experienced no symptoms of PTSD. Patients had a median pain score of 30 (IQR, 10–45), median satisfaction score of 60 (IQR, 45–70), median aesthetics score of 66.7 (IQR, 45.8–79.2), median palliative coping style score of 16 (IQR, 14.8–17.3), and median avoidance coping style of 15 (IQR, 13–16). Symptoms of PTSD were associated with pain ( $r, .530$ ;  $p < .001$ ), satisfaction with hand function ( $r, -.451$ ;  $p < .001$ ), aesthetics ( $r, -.320$ ;  $p < .009$ ), palliative coping style ( $r, .281$ ;  $p < .022$ ) and avoidance coping style ( $r, .283$ ;  $p < .022$ ). Pain and aesthetics remained significant after regression analysis. No interaction effects were significant.

*Conclusions* Pain and aesthetics statistically predict symptoms of acute PTSD in patients with acute hand injuries. Patients with disproportionate pain or dissatisfaction with aesthetics should be evaluated for PTSD.

*Type of study/level of evidence* Prognostic IV.

*Key words* Aesthetics; hand injury; pain; posttraumatic stress disorder.

An acute injury to one of the hands can be a disturbing event that might influence patients' physical, psychological, and social equilibrium. Furthermore, when symptoms of posttraumatic stress disorder (PTSD) develop, the outcomes of the injury may be worse. Because symptoms of PTSD are strong predictors of return to work in patients with acute hand injuries, it is clinically highly relevant to investigate which patients develop symptoms of PTSD, and which patients do not (1).

The Diagnostic and Statistical Manual of Mental Disorders–IV describes the criteria for PTSD as follows: (1a) symptoms of PTSD follow exposure to an extreme traumatic stressor; (1b) the person's response must involve intense fear, helplessness, or horror; (2) characteristic symptoms include persistent re-experiencing (ie, flashbacks, intrusive thoughts or nightmares) of the traumatic event; (3) the patient persistently avoids stimuli associated with the trauma (ie, avoiding thoughts, feelings, activities, places, or people associated with the trauma; numbing; sense of foreshortened future) and experiences numbing of general responsiveness; (4) the person has persistent symptoms of increased arousal (ie, difficulty falling or staying asleep, irritability, difficulty concentrating, exaggerated startle response); (5) the full symptom picture must be present for more than one month; and (6) the disturbance must cause clinically notable distress or impairment in social, occupational, or other important areas of functioning (2). In this study, we investigated symptoms of acute PTSD, meaning that the first symptoms should occur within the first 3 months after trauma. Patients who sustain an injury to the hand frequently develop symptoms of PTSD, but most of them do not meet criteria for the full diagnosis. In a previous study, we found that even few symptoms of PTSD greatly affect return to work in patients with hand injuries. Therefore, this study considers patients who experience only some symptoms of PTSD, and not patients who meet the full Diagnostic and Statistical Manual of Mental Disorders–IV criteria.

Symptoms of PTSD may be overlooked and remain untreated during rehabilitation of the physical symptoms (3;4), because most rehabilitation treatment is aimed at restoring hand function.

A great number of studies have analyzed predictors of symptoms of PTSD (5-12). A meta-analysis found that considerable social support after injury predicted fewer symptoms of PTSD, whereas personal factors (female gender, young age, and low educational level) and environmental factors (low socioeconomic status, high trauma severity, and family history of psychiatric disorders) predicted more symptoms

of PTSD (7). Gender was investigated as a moderator variable: Studies of men yielded significantly larger effect sizes for younger age at trauma ( $p < .01$ ), lower socioeconomic status ( $p < .01$ ), and race (minority status;  $p < .01$ ) than did studies of women (7). Besides these factors that predict symptoms of PTSD, other factors have been investigated, sometimes leading to conflicting results. Some of these factors will be described here, especially those assumed to be relevant for patients with acute hand injuries. The influence of injury severity on development of PTSD symptoms is not clear. Several studies could not establish an association between injury severity and PTSD (13-15). For instance, more severely burned patients were not more likely to develop PTSD (16) than less severely burned patients.

Pain has been identified as the core variable related to symptoms of PTSD in one case study (17), and other studies found significant associations ( $p < .001$ ) between pain and symptoms of PTSD (18-20). In those patients in whom pain was related to symptoms of PTSD, pain flashbacks were experienced instead of the more well-known visual or aural flashbacks (19;20). Post-trauma pain may also serve as a constant reminder of the trauma (21) and is an important stress factor in hand-injured patients (22), possibly evolving into PTSD. In patients with traumatic brain injury, more people with chronic pain reported symptoms of PTSD than those without pain (13). Disfiguring injuries are suggested to serve as ongoing reminders of the trauma (21) and can lead to persistent cosmetic and social acceptability concerns in hand-injured patients (23). Regardless of the degree of physical functioning or injury severity, female victims with cosmetic disfigurement are more likely than men to exhibit symptoms of PTSD (22;24).

Individuals who experience work-related injuries may be at an increased risk of developing symptoms of PTSD (22;25;26), especially when the injured worker perceives the injury to result from an employer's neglect or negligence (27). Returning to the accident site, seeing the machine that was involved in the accident, or hearing machine noises can elicit anxiety responses and thereby PTSD (21).

The influence of coping style on symptoms of PTSD has been investigated, but the results of these studies differ. In one study, repressive coping style was found to diminish the number of symptoms of PTSD (28), whereas another study found the opposite result (29). Satisfaction with hand functioning has been found to correlate with hand-related work performance and physical functioning. Better satisfaction with functioning of the hand is less distressing, and may lead to fewer symptoms of PTSD (30).

All these predictors of PTSD have been studied extensively, but not in hand-injured patients specifically. The aim of the present study was to identify which factors have predictive value on symptoms of acute PTSD in patients with acute hand injuries. Based on the above studies, we investigated the following factors: sociodemographic characteristics (age, gender, and educational level), injury severity, accident location (accident sustained on the job or elsewhere), post-trauma pain, satisfaction with functioning of the hand, aesthetics of the hand, social support, and coping styles. In our earlier study, we found that even a few symptoms of PTSD significantly ( $p < .05$ ) influence return to work (1). Because we expect that not many hand-injured patients can be diagnosed with acute PTSD, we investigated predictors of the number of symptoms of PTSD.

## Materials and Methods

Patients 18 years of age and older, who sustained an acute hand injury, were included in this cross-sectional study carried out between April 2006 and March 2007. Hand injury was defined as having damage to the structures of the hand (distal to the ulna and radius bones), caused by an injury. Patients had to be treated at the Department of Rehabilitation Medicine, Center for Rehabilitation

of the University Medical Center Groningen, the Netherlands, or at the Center for Rehabilitation

“Revalidatie Friesland” in Leeuwarden, the Netherlands, to participate in the study; no criteria have been put forth regarding injury severity. Median time between date of injury and date of research was 11 weeks (interquartile range, 6–19 weeks). Patients had to be employed and capable of reading and understanding Dutch. Patients with burn injuries, (chronic) hand disorders, or other severe co-morbidities with expected extensive influence on return to work were excluded from the study. Patients signed the informed consent form before taking part in the study. The local medical ethics committee approved the study.

### *Measurements*

The primary outcome measure was the number of symptoms scored on the Self-Rating Scale–PTSD (SRS-PTSD) (31;32), also called Symptoms of PTSD. Because the questionnaire was administered in an early stage of treatment, we investigated



symptoms of acute PTSD. The SRS-PTSD questionnaire consists of 22 items, which together measure 17 symptoms of PTSD. These symptoms can be further categorized into the 3 main symptoms of PTSD: avoidance, re-experiencing, and hyperarousal. To diagnose PTSD with this questionnaire, a patient should have at least 3 of 7 symptoms of avoidance, one of 5 symptoms of re-experiencing, and 2 of 5 symptoms of hyperarousal. Scores range between 0 and 17. The psychometric properties of the SRS-PTSD have been measured extensively and appeared to be sufficient (31;32). We obtained sociodemographic characteristics from medical charts and assessed them using a questionnaire. Sociodemographic characteristics were age, gender, and educational level. Educational level was dichotomized into low (no education, primary school, junior secondary vocational education, or junior general secondary education) or high (senior secondary vocational education, pre-university education, higher professional education, or university education) to create groups of sufficient size for further analyses.

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Patients also indicated whether their injury was sustained on the job or elsewhere, to assess accident location.

• • • • We derived injury severity from medical charts and categorized them using the Hand Injury Severity Scoring System (HISS), a descriptive scoring system for injuries to the hand, distal to the carpal bones. Each ray of the hand is assessed separately, and each ray's score is then multiplied by a weighting factor for that ray (thumb X 6; index X 2; long X 3; ring X 3; little X 2) and added to the scores of the other rays to obtain a total score for the injury. The scoring takes into account whether integument, skeletal, motor, or neural damage, or a combination of these, was damaged and whether the wound was contaminated (33). HISS categories were dichotomized into minor/moderate injuries and severe/major injuries; otherwise, groups were of insufficient size for further analyses. The HISS has good criterion and concurrent validity (34-36); no information about reliability is available.

Post-trauma pain, satisfaction with functioning of the hand, and aesthetics of the hand were measured with subscales of the Michigan Hand Outcome Questionnaire (30). The time frame for the last 2 subscales was the week before the investigation. Scores from all scales were normalized to a range of 0 to 100. Test-retest reliability and internal consistency were high on all scales of the Michigan Hand Outcome Questionnaire, and strong evidence for construct validity has been found; only correlations between the aesthetics scale and other scales were moderate because this scale measures a factor that is distinct from the other (functional) scales (30).

On the satisfaction scale, possible answers were “very satisfied,” “satisfied,” “neutral,” “dissatisfied,” and “very dissatisfied.” On the aesthetics scale, possible answers were “totally agree,” “agree,” “neutral,” “disagree,” and “totally disagree.” If a patient never experienced pain, he or she did not have to answer the following pain questions. If he or she answered “always,” “often,” “sometimes,” or “rarely” to this question, the patient was asked how severe the pain was (minimal, light, moderate, severe, or very severe). Finally three questions asked how often pain disturbed sleep, daily activities and happiness. Possible answers were “always,” “often,” “sometimes,” “seldom,” and “never.” For hand function and aesthetics, higher scores indicate better hand performance, whereas a higher pain score indicates greater pain.

We assessed social support with the Social Support List Interactions (SSL12-I) (37;38). This questionnaire consists of 12 items, and scores range from 12 to 48. The SSL12-I is internally consistent in an elderly population and has sufficient construct validity (37;38). Patients answer whether there are occasions when another person offers some kind of social support. Possible answers were “seldom/never,” “sometimes,” “regularly,” and “often.” A high score on the SSL12-I indicates that the person receives social support frequently.

Coping styles were measured with the Utrecht Coping List (39-41). This questionnaire consists of 45 items divided over seven subscales: active coping (range, 7-28), palliative reaction (range, 8-32), avoidance (range, 8-32), social support seeking (range, 6-24), passive reaction pattern (range, 7-28), expression of emotions (range, 3-12), and reassuring thoughts (range, 5-20). The Utrecht Coping List is internally consistent and has moderate test-retest reliability, and the content and criterion validity are moderate (39-41). Each item states a way of reacting (for instance, passive or active coping) to a problem. Possible answers were “seldom/never,” “sometimes,” “regularly,” and “often.” Some item scores had to be recoded before calculating sum scores. A high score on one of the scales indicates that the subject displays this coping style often. No total sum score can be calculated, so analyses have to be performed with each scale separately.

### *Statistical analyses*

We used Pearson’s correlations (age, social support, pain, satisfaction, aesthetics, and coping styles) and Mann-Whitney U tests (gender, educational level, injury severity, and accident location) to analyze univariate associations with Symptoms of PTSD.

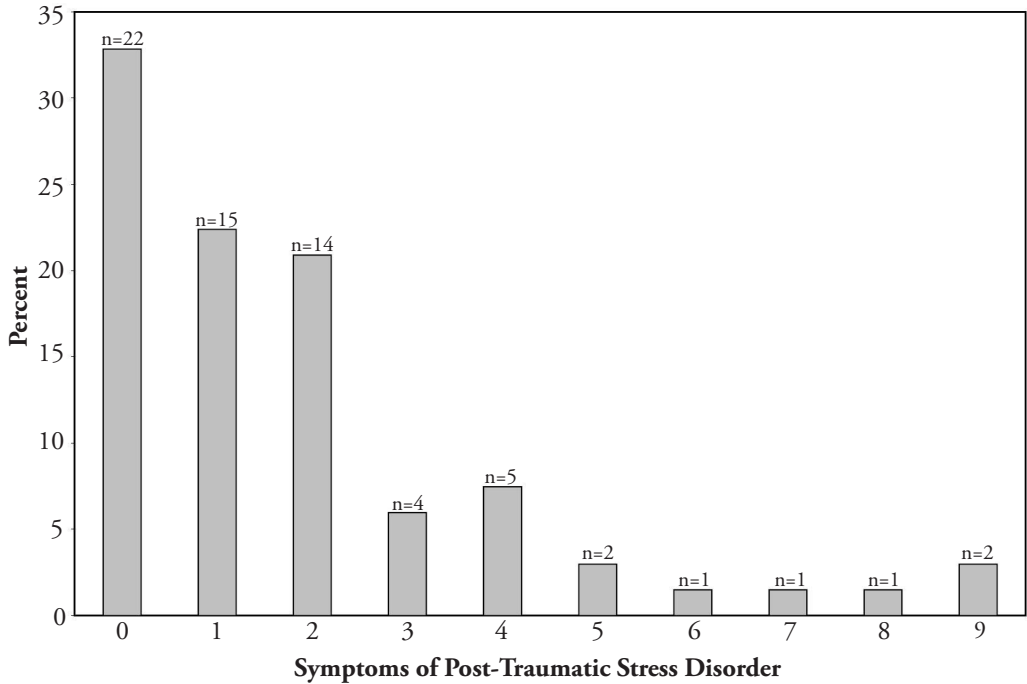


Linear regression analysis (stepwise backward) was performed to identify predictors of Symptoms of PTSD. Associations were considered to be significant when p values were lower than .05. Variables that were univariately significantly associated with Symptoms of PTSD were entered in the analysis. We explored interaction effects between determinants.

Results

Figure 1 shows the distribution of the number of symptoms of PTSD of the 67 participants. The median number of Symptoms of PTSD was one (IQR, 0–2). A total of 22 patients showed no Symptoms of PTSD. No significant associations between gender, educational level, injury severity, accident location, and Symptoms of PTSD were found (Table 1). Age (mean, 42.0 years; standard deviation, 12.1 years) was not associated with the number of Symptoms of PTSD. A higher number of Symptoms of PTSD was associated with more pain and a more palliative or avoidant coping style (Table 2). Higher scores on satisfaction and aesthetics were associated with fewer Symptoms of PTSD (Table 2).

Figure 1: Frequency of Symptoms of Post-Traumatic Stress Disorder in hand-injured patients



**Table I: Symptoms of PTSD presented for gender, level of education, injury severity and accident location**

		n(%)	S-PTSD Median (IQR)		n(%)	S-PTSD Median (IQR)	MWU
<b>Gender</b>	<i>Male</i>	52 (78)	1 (0 to 3)	<i>Female</i>	15 (22)	1 (0 to 2)	n.s.
<b>Educational level</b>	<i>Low</i>	31 (48)	1 (0 to 3)	<i>High</i>	34 (52)	1 (0 to 2)	n.s.
<b>Injury Severity</b>	<i>Mild/ moderate</i>	36 (57)	1 (0 to 2)	<i>Severe/ major</i>	27 (43)	2 (1 to 3)	n.s.
<b>Accident Location</b>	<i>On the job</i>	30 (46)	2 (1 to 3)	<i>Elsewhere</i>	35 (54)	1 (0 to 2)	n.s.

S-PTSD = Symptoms of Posttraumatic Stress Disorder; n = number of patients, IQR = Inter Quartile Range; MWU Mann Whitney U tests; n.s. = Not significant

**Table II: Descriptive statistics of potential determinants of symptoms of PTSD and their associations with the number of symptoms of PTSD.**

	Median	IQR	Pearson r
S-PTSD	1	0 to 2	-
Hand outcomes			
Pain	30	10 to 45	.530 (p<.001)
Satisfaction with hand function	60	45 to 70	-.451 (p<.001)
Aesthetics	66.7	45.8 to 79.2	-.320 (p=.009)
Social support	31	26 to 36	n.s.
Coping styles			
Active coping	16	14 to 18	n.s.
Palliative reaction	16	14.8 to 17.3	.281 (p=.022)
Avoidance	15	13 to 16	.283 (p=.022)
Social support seeking	12.5	11 to 15	n.s.
Passive reaction pattern	10	8 to 11	n.s.
Expression of emotions	6	5 to 6	n.s.
Reassuring thoughts	12	10.8 to 14	n.s.

S-PTSD Symptoms of Post-Traumatic Stress Disorder; SD Standard Deviation; IQR Inter Quartile Range; n.s. = not significant

### *Predictors of Symptoms of PTSD*

In the stepwise backward regression analysis, main effects were found for pain and aesthetics (Table 3); these variables explained 33.9% of the total variance. Experiencing more pain was associated with more Symptoms of PTSD, whereas valuing aesthetics of the hand more positively was associated with fewer Symptoms of PTSD. The interaction between pain and aesthetics was not significant.

**Table III: Predictors of Number of Symptoms of PTSD, Results of Linear Regression Analysis**

Independents	Beta	S.E. Beta	Sig.	95% Confidence Interval for Beta	Adjusted R <sup>2</sup>
Constant	2.628	.928	.006	.775 to 4.482	
Pain	.043	.011	<.001	.021 to .064	
Aesthetics	-.037	.013	.007	-.064 to -.011	33.9%

S.E. Standard Error; Sig. Significance

## Discussion

The present study investigated predictors of Symptoms of acute PTSD in patients with acute hand injuries. Pain, satisfaction with hand function, aesthetics, palliative coping style, and avoidant coping style were associated with Symptoms of PTSD. Of these variables, pain and aesthetics appeared to be the main (statistical) predictors for Symptoms of PTSD in acute hand-injured patients. Only one patient met the criteria for acute PTSD; other patients showed symptoms of PTSD but did not meet the criteria.

Pain experienced during and immediately after the accident is a risk factor for PTSD in patients with physical injuries 4 and 8 months post-injury (42). Although the present cross-sectional study measured post-trauma pain experienced at the time of research (median interval between trauma and research, 11 weeks), we also found pain to predict Symptoms of PTSD statistically. This result gives reason to assess patients with disproportionate pain for symptoms of PTSD and, if necessary, provide psychological support.

The influence of aesthetics on symptoms of PTSD has been investigated in burn injuries and limb amputations (24;43-45). The degree of cosmetic disfigurement is related to symptoms of avoidance and emotional numbing in women (24). Patients' negative reactions to the sight of the hand have been associated with both trauma-related distress and mood disorders (46). It is suggested that loss of a hand or arm is more traumatic than the loss of parts of lower extremities, because of its highly symbolic and multifunctional nature. Visible disabilities may be more distressing than conditions that are equally disabling but better masked (45). Our results indicate that attention should be given to patients' reaction to the sight of the hand, so that psychological support can be offered if necessary to prevent symptoms of PTSD. Aesthetics of the injured hand are important for both the surgeon and the

rehabilitation team. The surgeon should put effort into maximizing aesthetics of the hand during surgery. The rehabilitation team should put effort into reducing scar tissue and should pay attention to patients' reaction to the aesthetics of the hand (46).

Factors related to PTSD have been studied extensively, but not in hand-injured patients specifically (7;11). Potentially predicting factors investigated in this study were selected on the basis of literature and assumed clinical relevance for hand-injured patients. The number of associations with Symptoms of PTSD and the explained variance with pain and aesthetics indicate that we indeed succeeded in choosing at least some relevant factors; however, the sample size was limited. Therefore, this study should be replicated in larger populations, enabling exploration of interactions among gender and other risk factors, because gender moderates the relations between different predictors and symptoms of PTSD (7;22;24).

At first, it seems striking that we found no influence of social support on Symptoms of PTSD in this study, whereas lack of social support has repeatedly been found to predict PTSD in other studies (7;11). We pose two possible explanations. First, the questionnaire (SSL12-I) refers to no specific time frame. Thus, it is not clear whether the questions refer to the current situation or the pre-trauma situation. It could be that patients answered the questionnaire with their pre-trauma lives in mind. Second, "lack of social support" refers to social support that is missing according to the Patient (7;11). We measured the social support patients actually experienced, not the lack of it.

The current study found minor Symptoms of PTSD, although it is not clear how they might influence daily functioning. We found that few Symptoms of PTSD influenced return to work in a previous study (1). It is not clear whether and how these symptoms should be treated. Current treatments for PTSD are probably not suitable because they are often psychologically intervening and directive (47). Perhaps so-called psychological first aid consisting of respective and supportive noninterventionist treatment to patients at an early stage of rehabilitation may be beneficial (47). In-depth analysis is needed to determine the content of such a first-aid package, thereby considering the needs of patients with hand injuries, what is already offered in regular treatment, and the type of support that should be added (48). It might be interesting to analyze the effects on symptoms of PTSD of a first-aid package for patients with hand injuries in an early phase of recovery.

A limitation of our study might be the choice of the study design. A cross-sectional design is suitable for explorative studies. A first idea can be developed

about how relations among variables might exist. However, no conclusions about causal relationships can be drawn from a cross-sectional study design. Results should be interpreted with caution. Therefore, only statistical relations with Symptoms of PTSD are described in this study. A next study could be a case-control study, which would compare subjects who experience symptoms of PTSD with subjects who do not have such symptoms. Differences between these patient groups might bring forth interesting information about which patients are or are not vulnerable to developing symptoms of PTSD. Although time-consuming, another option for an alternative study design might be a prospective study, in which all hand-injured patients are observed from trauma to complete (psychological) recovery.

Because aesthetics and pain are statistical predictors of Symptoms of PTSD, we cannot determine the direction of this relation with the current study design. The literature on this topic remains inconclusive. Pain has been found to be a cause of PTSD, leading to pain flashbacks (17-20). However, these studies were case studies and cross-sectional studies, so no final conclusion can be drawn from them. The direction of the relation should be investigated in future prospective studies.

In conclusion, pain and aesthetics are statistical predictors of Symptoms of PTSD in acute hand-injured patients. Because pain and aesthetics are probably easier to assess than most symptoms of PTSD, patients who report pain or who have negative comments on the aesthetics of their hand should be carefully monitored for symptoms of PTSD.

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